Improving Production Performance of Peranakan Ongole Cows and Nutrient Digestibility of Rice Straw Based Diet with Energy-Protein Supplementation Given Separately or in Complete Feed

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Abstract

Climate is the limiting factor for availability of good quality forage in Rembang regency. Rice straw is then given as an alternative feed for Peranakan Ongole (PO) cows. However, this feed is low in nutrient content and quality has low digestibility and low palatability. Overcoming this problem can be done by designing good quality supplements, such as nutrient rich supplement (SKN) that can be mixed with concentrate, or can be formulated in a complete feed. Therefore, this experiment was conducted to study responses of PO cows to improvement of rice straw based diet with supplementation and complete feed. The experiment was carried out in a randomised block design with 16 cows were allocated randomly into 4 groups. The treatments were R1 (rice straw), R2 (R1 + rice bran 2 kg/head/day), R3 (R2 + SKN 0.4 kg/head/day), and R4 (complete feed). The data were analysed using analysis of variances and differences among treatments were examined with contrast orthogonal test. The results showed that the use of rice bran, SKN and complete feed improved quality of rice straw as based diet which subsequently improved nutrient intakes. The treatments were significant on dry matter and crude protein digestibilities ($P<0.05$), but did not affect organic matter and energy digestibility, body weight gain and feed efficiency. The highest income over feed cost was obtained by using R2. It is concluded that giving complete feed (R4) produced the best performance of PO cows. SKN can still be used to improve rice straw based diet if the amount is increased.

Keywords: complete feed, peranakan ongole cows, rice straw, SKN, supplementation

Introduction

Rembang Regency is the 4th rank for beef cattle production in Central Java Province, populations were 115,220 heads in 2009 with Peranakan Ongole (PO) was one of cattle breeds raised by farmers (Government of Rembang Regency, 2011). Cattles are used to meet local requirement for meat, and exported to other regencies in Java Island. However, climate is the limiting factor for raising the cattle and for the availability of good quality forage; this was because: 1. its location in low land area in the north coastal area of Java island; 2. having tropical climate (maximum temperature 33 ^{o}C and average temperature 23 ^{o}C); 3. short period of wet season (4-5 month/year) with long period of dry season, and 4. scarcity in rain drops in a year (average rain drops 1 039.36 mm in 2009) (Agricultural and Forestry Office, Rembang Regency, 2009).

Rice straw is given as an alternative feed for PO cows, but it has low nutrient content and quality, low digestibility and low palatability (Sutardi, 1981). One solution to overcome the problem is by designing good quality supplements (Suryahadi *et al*., 2003; Leng, 1993), i.e. nutrient rich supplement (SKN, *suplemen kaya nutrien*) containing good quality of energy, protein and mineral sources, that can be mixed with concentrate, or can be formulated in a complete feed. These supplements are expected to provide nutrients lacking in rice straw and can be given in a small amounts to improve rice straw utilisation. These can be formulated by using feed sources available locally in Rembang Regency or nearby cities (CENTRAS, Centre for Research and Community Service, IPB, - Government of Rembang Regency, 2010). Fish meal from locally fish industry and leguminous leaf meals (leucaena, *Leucaena leucocephala*; and turi, *Sesbania grandiflora*) are undegradable protein sources, and degradable protein sources are cassava meal (*Manihot esculenta*) and rice bran cassava leaf meal and rice bran had protein that were less degradable than fish meal, soybean meal and the other two legume leaf meal; so would you mind to leave the previous statement as it is(Sutardi *et al*., 1983; Soenarso, 1984). Rice bran and molasses are highly fermentable energy sources than rice straw. Mineral sources are also provided. These are expected improve animal performance. Therefore, this experiment was conducted to study responses of PO cows to improvement of rice straw based diet with supplementation and complete feed.

Materials and methods

Mature PO cows (16 heads) were used (aged : 2-6 years old and initial body weight, BW : 304.31 $\pm$ 30.1 kg), divided into four groups and kept in an individual cage. Feeds were rice straw (*Oryza sativa*), leaf meal containing cassava, leucaena, and turi, fish meal, rice bran, molasses and mineral mixed from Rembang, Tuban and Pati districts.

Four treatments were developed based on observation in feeding practise conducted by farmers in Rembang Regency: R1=Rice straw (*ad libitum*); R2= R1+rice bran as energy supplement (2 kg/head/day); R3=R2+SKN (0.4 kg/head/day); supplement was given separately, and R4= Rice straw base complete feed in which rice straw and energy - protein supplement (SKN) was mixed and given as a single feed. Complete feed: rice straw 40, rice bran 30.5, fish meal 8.5, cassava leaf meal 5.7, leucaena leaf meal 3.0, sesbania (turi) leaf meal 0.3, molasses10, vegetable oil 1 and mineral mix 1 (% dry matter, DM basis).

Variables measured were feed and nutrient intakes, digested nutrients, nutrient digestibilities, body weight gain (BWG), feed or ration efficiency ratio (FER), and income over feed cost (IOFC). Randomised block design (4 treatments and 4 replications), analysis of variance and contrast orthogonal were applied (Steel and Torrie, 1993).

Results and Discussion

The study was done in a community farm taken care by 18 members and located in Tanjung village, Sulang district, Rembang Regency (July to September 2010). PO cattles (mature bulls 2 heads, mature cows 16 heads, and calves 4 heads) were mostly kept for fattening and breeding programmes. As keeping cattle is the secondary income, the farmers look after the cattle traditionally and give feeds

Table 1. Nutrient composition of ration

Nutrient composition1	Treatment			
	Rice straw (R1)	Rice straw + supplement		Complete feed (R4)
		Rice bran (R2)	Rice bran + SKN (R3)	
Dry matter (DM, % fresh sample)	37.99	50.44	52.05	60.44
Ash (% DM)	17.40	17.19	17.08	18.75
Organic matter (% DM)	82.60	82.81	82.92	81.25
Crude protein (% DM)	4.21	5.92	6.48	11.80
Ether extract (% DM)	1.44	2.48	2.71	3.52
Crude fibre (% DM)	32.50	31.02	30.44	25.80
Nitrogen free extract (% DM)	44.45	43.39	43.30	40.12
Ca (% DM)	0.42	0.30	0.41	2.65
P (% DM)	0.28	0.54	0.52	0.29

[1] Calculated on the basis of data from Sutardi (1981) and proximate analysis by the Laboratory of Research Centre of Natural Resources and Biotechnology, Bogor Agricultural Institute (2011).

available seasonally having low quantity and quality which were insufficient to support production and reproduction of animals.

R1 had the lowest nutrient contents, excepted for CF content (Table 1). Rice bran supplementation (2 kg/head/day) improved nutrient contents in R2 with further improvements were obtained in R3 and R4. These affected intakes of rice straw DM, total nutrients (DM, OM, and CP) ($P<0.01$) and TDN ($P<0.05$), but did not af-

Table 2. Intake, digested nutrient, nutrient digestibility of rice straw based diet, body weight gain and feed efficiency ratio

Variables	Treatment			
	Rice straw (R1)	Rice straw + supplemen		Complete feed (R4)
		Rice bran (R2)	Rice bran + SKN (R3)	
Intakes (kg/head/day):				
Fresh	9.28 ± 1.43	8.75 ± 0.57	9.15 ± 0.67	10.08 ± 1.63
Rice straw (DM)[1]	3.52 ± 0.56[a]	2.60 ± 0.16[b]	2.63 ± 0.32[b]	1.87 ± 0.31[c]
Total dry matter[1]	3.52 ± 0.56[c]	4.42 ± 0.16[b]	4.76 ± 0.32[b]	6.09 ± 0.90[a]
Total organic matter[1]	2.91 ± 0.46[c]	3.66 ± 0.13[b]	3.95 ± 0.26[b]	4.95 ± 0.73[a]
Total crude protein[1]	0.15 ± 0.02[c]	0.26 ± 0.01[b]	0.31 ± 0.01[b]	0.72 ± 0.11[a]
TDN[1,2]	2.11 ± 0.41[b]	2.53 ± 0.38[b]	2.75 ± 0.20[a]	2.94 ± 0.38[a]
Digested nutrient (kg) :				
Digested DM	2.32 ± 0.48	2.73 ± 0.49	2.97 ± 0.25	2.94 ± 0.41
Digested OM	2.05 ± 0.40	2.40 ± 0.37	2.61 ± 0.19	2.72 ± 0.35
Digested CP1	0.03 ± 0.02[a]	0.13 ± 0.04[b]	0.15 ± 0.02[b]	0.45 ± 0.06[c]
Digested energy (MJ)	38.81 ± 7.57[a]	46.62 ± 6.90[a]	50.61 ± 3.64[b]	54.09 ± 6.92[b]
Digestibility (%):				
Dry matter (DM)[1]	65.41 ± 3.65[a]	61.84 ± 10.09[a]	62.57 ± 6.17[a]	48.65 ± 6.94[b]
Organic matter (OM)	69.99 ± 3.17	65.62 ± 9.09	66.34 ± 5.56	55.34 ± 6.05
Crude protein (CP)[1]	18.55 ± 8.60[a]	50.40 ± 13.25[b]	49.27 ± 8.95[b]	62.67 ± 4.88[c]
Digestible energy (DE, MJ/kg BK)	10.97 ± 0.48	10.55 ± 1.39	10.65 ± 0.88	8.93 ± 0.93
BWG and FER				
BWG (kg/head/day)	0.06 ± 0.30	0.29 ± 0.43	0.31 ± 0.12	0.66 ± 0.34
FER (%)	2.08 ± 8.36	6.56 ± 10.06	6.34 ± 2.29	10.78 ± 5.57

[1]Means with different superscript in the same row differ significantly at ($P<0.05$); [2]TDN (total digestible nutrient) was estimated using this formula: TDN = digested crude protein + 2.25 digested ether extract + digested crude fibre + digested nitrogen free extract (Sutardi, 1980).

fected fresh feed intake (Table 2). Increases in total energy and CP intakes followed ascending order: R2, R3 and R4.

Treatments affected digested energy and CP ($P<0.05$) with the lowest in R1 (Table 2), and the highest in R4 ($P<0.05$). Digested nutrients were also improved by rice bran supplementation (R2), but its combination with SKN (R3) only increased digested energy. The increase in CP digestibility ($P<0.05$) occurred in a similar trend, but reverse results were found in DM and OM digestibility, and digestible energy (DE). The lowest results in energy digestibility were complete feed ($P<0.05$), and the highest were rice straw (R1). As bulky feeds with high CF content, rice straw filled the digestive tract stimulating satiety sensation in faster rate, slowering passage rate, decreasing its DM intake and increasing its digestion.

Supplementation improved BWG and FER biologically (Table 2) that were similar to others (Purnomoadi *et al*., 2007; Arifin *et al*., 1998). The same effects also occurred in IOFC, but in descending order: R2, R3 and R4 (Table 3) due to the high cost of supplement (SKN) increasing the price of complete feed with a greater use of SKN.

Table 3. Income over feed cost for cattle given rice straw based diet and supplement

Variables	Treatment			
	Rice straw (R1)	Rice straw + supplement		Complete feed (R4)
		Rice bran (R2)	Rice bran + SKN (R3)	
Rice straw DM intake (kg/head/day)	3.52	2.60	2.63	-
Rice bran DM intake (kg/head/day)	-	1.82	1.82	-
SKN DM intake (kg/head/day)	-	-	0.31	-
Complete feed DM intake (kg/head/day)	-	-	-	6.09
Total feed cost (Rp/day)[1]	704.83	2,339.04	3,241.37	12,926.03
Body weight gain (BWG, kg/head/day)	0.06	0.29	0.31	0.66
BWG values (Rp/head/day)[2]	1,412.4	6,465.25	6,710.55	14,421.55
Income over feed cost (Rp/head/day)	707.57	4,126.21	3,469.18	1,495.53

[1]Feed price in July 2010: rice straw= Rp. 200,-/kg; rice bran= Rp. 1000,-/kg; SKN= Rp. 2890,-/kg; complete feed= Rp. 2122,50/kg; [2]Cattle selling price= Rp. 22000,-/kg live weight.

Supplementation produced good effects through the increase in availability of good quality nutrients (energy sources, combination between degradable and undegradable protein and mineral addition) for rumen microbes to improve its ability to ferment rice straw based diet and synthesis its protein and for ruminants to digest the nutrients intensively in post ruminal digestive tract (Suryahadi *et al*., 2003). Lack of significant effects on BWG and FER was due to small amount of supplement (SKN) given to the animals and variation in responses among cattles.

Conclusion

Biological effects of rice straw based diet supplemented with rice bran has increased efficiency of nutrient utilisation, especially energy. Further increases were obtained by supplementing with SKN. Given rice straw, rice bran and SKN in a complete feed produced the best performance based on efficiency of energy utilisation (TDN and DE values) and BWG, and the best IOFC. The highest IOFC produced by using rice bran as supplement was due to the high price of SKN and the highest cost of producing complete feed. It is recommended to improve nutrient quality and quantity of supplements, to reformulate SKN composition and ratio between SKN and rice straw in complete feed, and to produce supplements at low cost in order to increase income over feed cost for the farmers.

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